Amendments to Specification

Please replace a paragraph **[0001]** with the following amended paragraph:

[0001] The present invention relates to apparatus and method for measuring displacement for measuring the displacement amount of a surface of a measuring object without contact by scanning an irradiation point formed by light radiated onto the surface of the measuring object at a fixed interval utilizing triangulation by light. Particularly, the present invention relates to apparatus and method for measuring displacement for enhancing displacement detection precision and a measurement rate using a lens array. The present invention also relates to apparatus and method for measuring displacement that ~~enables~~ enable precisely acquiring the amount of displacement by correcting an error due to the dispersion of a position and a direction in which a lens array is installed and the focal length.

Please replace a paragraph **[0024]** with the following amended paragraph:

[0024] Therefore, measuring beams converged by the lens array can be imaged on the light receiving plane in a state in which aberration is small. Hereby, the displacement of the surface of the measuring object can be precisely measured. Particularly, even if measuring beams on the side of one light receiving means are intercepted by difference in a level on the surface of the measuring object and the sufficient amount of beams ~~are~~ is not acquired, the displacement is measured by beams acquired by the other light receiving means and the precision of measurement can be maintained.

Please replace a paragraph **[0028]** with the following amended paragraph:

[0028] As described in an eighth aspect, the displacement operation means is provided with an adder and a subtracter in every light receiving means. The adder adds a pair of electric signals

after ~~a pair of~~ the electric signals acquired in an image formation position on each light receiving plane of the light receiving element are respectively converted from current to voltage. The subtracter subtracts one of the pair of electric signals from the other respectively. The displacement operation means may be also provided with an addition signal adder that adds addition signals acquired each adder, a subtraction signal adder that adds subtraction signals acquired from each subtracter and a divider that divides an electric signal acquired in the subtraction signal adder by an electric signal acquired in the addition signal adder.

Please replace a paragraph **[0030]** with the following amended paragraph:

[0030] Further, as described in a ninth aspect, the above-mentioned displacement operation means is provided with an adder, a subtracter and a divider in every light receiving means. The adder adds a pair of electric signals after ~~a pair of~~ the electric signals acquired in an image formation position on the light receiving plane of the light receiving element are respectively converted from current to voltage. The subtracter subtracts one of the pair of electric signals from the other. The divider divides a subtraction signal acquired in the subtracter by an addition signal acquired in the adder respectively. The displacement operation means may be also provided with switching means to which each displacement signal corresponding to a value divided in each divider and a displacement signal corresponding to the average value of the divided values are input and which outputs any displacement signal, level determination means that determines whether each addition signal meets a predetermined reference value or not and selecting means that selectively outputs a suitable one of each displacement signal input to the switching means based upon the result of determination in the level determination means.

Please replace a paragraph **[0041]** with the following amended paragraph:

[0041] BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic perspective view showing apparatus for measuring displacement according to the invention;

Fig. 2 is a side view showing the apparatus for measuring displacement according to the invention;

Fig. 3 is a block diagram showing displacement operation means of the apparatus for measuring displacement according to the invention;

Figs. ~~4~~ 4A to 4E are top views respectively showing an image formation point corresponding to the scan of an irradiation point in light receiving means in an embodiment of the invention;

Figs. ~~5~~ 5A and 5B are side views respectively showing an image formation point corresponding to the irradiation point in the light receiving means in the embodiment of the invention;

Fig. 6 is a schematic perspective view showing apparatus for measuring displacement equivalent to a second embodiment of the invention;

Fig. 7 is a side view showing the apparatus for measuring displacement equivalent to the second embodiment of the invention;

Fig. 8 is a block diagram showing displacement operation means of the apparatus for measuring displacement equivalent to the second embodiment of the invention;

Fig. 9 is a side view showing the operation of the apparatus for measuring displacement equivalent to the second embodiment of the invention;

Fig. 10 is a side view showing a state in which scattered light is intercepted in case there is difference in a level in the vicinity of an irradiation point on a measuring object;

Fig. 11 is a block diagram showing another displacement operation means in the second embodiment of the invention;

Fig. 12 is a block diagram showing the other displacement operation means in the second embodiment of the invention;

Fig. 13 is a block diagram showing the electric configuration of the apparatus for measuring displacement;

Fig. 14 is a flowchart showing a calibration mode of the apparatus for measuring displacement according to the invention;

Fig. 15 is a front view showing a state in the calibration mode in which the equipment is installed;

Fig. 16 is the side view;

Fig. 17 shows deviation detected in the calibration mode of the apparatus for measuring displacement according to the invention;

Fig. 18 is a flowchart showing a measurement mode of the measuring object;

Figs. ~~19~~ 19A to 19C are explanatory drawings for explaining processing for solving deviation caused in a lens array;

Fig. 20 is a schematic drawing showing conventional type apparatus for measuring displacement;

Fig. 21 is a schematic perspective view showing conventional scanning-type apparatus for measuring displacement;

Figs. ~~22~~ 22A and 22B show the operation of a light receiving system of the conventional scanning-type apparatus for measuring displacement;

Fig. 23 shows an image formation point imaged on the light receiving plane of the conventional type apparatus for measuring displacement; and

Fig. 24 is a side view showing a state in which scattered light is intercepted in case there is difference in a level in the vicinity of an irradiation point on a measuring object.

Please replace paragraphs **[0052]** and **[0053]** with the following amended paragraphs:

[0052] The electric signals A and B are output to displacement operation means shown in Fig. 3. A pair of current/voltage converters I/V for converting the electric signals A and B from current to voltage ~~are~~ is provided to the displacement operation means 10. The electric signals A and B converted in each current/voltage converter I/V are respectively output to an adder 12 and a subtracter 13. In the adder 12, the electric signals A and B are added and an addition signal is output. In the subtracter 13, the electric signal A or B is subtracted from the electric signal B or A and a subtraction signal is output. The

addition signal and the subtraction signal are input to a divider 14, division is performed there and a displacement signal D is output.

[0053] Next, referring to Figs. 1 to ~~5~~ 5A and 5B, the action of this embodiment will be described. Light radiated from the light source 3 is deflected by the deflector 4 and is scanned at a predetermined stroke. The scanned radiated light is incident on the convergent lens 5 to be parallel beams and forms an irradiation point on the surface 30a of the measuring object. The radiated light is reflected or scattered every irradiation point P and reflected or scattered light (measuring beams) is/are outgoing to the side of the light receiving means 6.

Please replace a paragraph **[0057]** with the following amended paragraph:

[0057] As shown in Fig. 4B, the irradiation point P is displaced to a position intersected with the optical axis of the condenser lens 7a of the lens array 7 by the scan of the irradiation point P. Light (measuring beams) reflected or scattered from this irradiation point P is/are converged mainly by the condenser lens 7a to be substantially parallel. The converged measuring beams are incident ~~with them~~ parallel to the optical axis of the imaging lens 8. Therefore, an image Ka of the irradiation point P is formed in a substantially central position in the direction of the light receiving width of the light receiving plane 9a of the light receiving element 9.

Please replace a paragraph **[0064]** with the following amended paragraph:

[0064] A pair of electric signals A and B accurately corresponding to the displacement in the height of the surface 30a of the measuring object 30 ~~are~~ is output to the displacement operation means 10 from the light receiving element 9. The electric signals A and B are respectively converted to voltage by the current/voltage converters I/V as shown in Fig. 3. The converted electric signals A and B are respectively output to the

adder 12 and the subtracter 13. After addition and subtraction, an addition signal is output from the adder 12, a subtraction signal is output from the subtracter 13, divider 14 divides the electric signal A by the electric signal B and a displacement signal D is output from the divider 14. The displacement of the surface 30a of the measuring object can be measured based upon the displacement signal D.

Please replace a paragraph **[0070]** with the following amended paragraph:

[0070] This embodiment is an example in which the projecting means 2 in the first embodiment is arranged in a position that light radiated from the projecting means is vertically incident on the surface 30a of a measuring object and a pair of light receiving means 6 (6-1, 6-2) ~~are~~ is provided in positions symmetrical with the optical path plane of scanned radiated light so that measuring beams scattered at an irradiation point P can be received as shown in Figs. 6 and 7. The description of the configuration and functions respectively common to those in the first embodiment is omitted below.

Please replace a paragraph **[0075]** with the following amended paragraph:

[0075] A pair of electric signals (A1, B1) and (A2, B2) accurately corresponding to the displacement of the height of the surface 30a of the measuring object 30 ~~are~~ is respectively output from each light receiving element 9 (9-1, 9-2). The displacement of each surface 30a of the measuring object can be measured based upon these electric signals.

Please replace a paragraph **[0087]** with the following amended paragraph:

[0087] ~~As~~ The individual addition signals and individual subtraction signals are respectively added according to displacement operation means 20 shown in Fig. 11 even if the sensitivity and others of both light receiving means 6-1 and 6-2

are unbalanced. Therefore, the gain control and others of a current-voltage converter can be facilitated and displacement measurement precision can be enhanced.

Please replace a paragraph **[0120]** with the following amended paragraph:

[0120] Figs. ~~19~~ 19A to 19C show deviation caused due to the dispersion of positions where condenser lenses in the lens array are set and others. Fig. 19A shows the contour of the surface 30a of the measuring object 30B.